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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/056,915	01/25/2002	Leroy E. D'Astolfo	01-0219	3742

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EXAMINER	
WILKINS III, HARRY D	

ART UNIT	PAPER NUMBER
1742	

DATE MAILED: 12/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/056,915	D'ASTOLFO ET AL.	
	Examiner	Art Unit	
	Harry D Wilkins, III	1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 October 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 January 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. The rejection under 35 USC 112, 2nd paragraph has been withdrawn in view of Applicant's amendment.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-3, 5-9, 11-15, 17-19 and 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admission of prior art in view of "Permatech Beta 2HPSL (With Stainless Steel Fibers)" and "Refractories".

Applicant admits as prior art (see paragraph 4) that supports for an anode system in contact with a molten salt bath in an electrolysis apparatus were made from dense castable refractories subject to thermal shock and attack by gases from the bath.

However, Applicant does not admit that the dense castable refractory had a 50-95% theoretical density, with 2-20 wt% metal fibers included therein.

"Permateach Beta 2HPSL (With Stainless Steel Fibers)" teaches an 87-89% theoretical density (11-13% apparent porosity) castable refractory with stainless steel fibers that provides "very good" thermal shock resistance.

"Refractories" teaches stainless steel fibers, (see 3rd paragraph on page 3) preferably 1-3/8" (3.49 cm) in length, for incorporation into a castable refractory that (see figure 2 and 2nd paragraph on page 4), when added at 2-6 wt%, improve the

thermal shock resistance of the refractory and, as can be seen in figure 3, have a length to thickness ratio in the range of 500:1 to 20:1. The fibers of "Refractories" are (see 4th-6th paragraphs on page 1) superior to normal fibers because of increased ductility that allow better separation during mixing, thus providing a more uniform composite.

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated the fiber reinforced castable refractory of Permatech for the prior art anode support because the reinforcement greatly increased the thermal shock resistance of the refractory and it would have been obvious to have used the metal fibers of "Refractories" because the fibers provide better mixing properties, thus providing a more uniform composite.

Though "Permatech Beta 2HPSL (With Stainless Steel Fibers)" is silent as to the number of fibers protruding from the surface of the support, it was known that HF could corrode the stainless steel (see Dean, Jr at col. 1, lines 22-27). Therefore, it would have been obvious to have reduced the number of fibers protruding from the surface of the support to a low value, such as less than 20 per cm^2, in order to reduce the amount of corrosion of the fibers, thereby preventing failure of the composite.

Regarding claim 7, Applicant admits as prior art (see paragraph 4) that support assemblies made form castable refractories for an inert anode system contained at least one inert anode attached to the support system, and the anode and support being in contact with a molten salt bath in an electrolysis apparatus and subject to thermal shock and attack by gases from the bath. Though "Permatech Beta 2HPSL (With Stainless Steel Fibers)" is silent as to the number of fibers protruding from the surface of

the support, it was known that HF could corrode the stainless steel (see Dean, Jr at col. 1, lines 22-27). Therefore, it would have been obvious to have reduced the number of fibers protruding from the surface of the support to a low value, such as less than 20 per cm^2, in order to reduce the amount of corrosion of the fibers, thereby preventing failure of the composite.

Regarding claim 17, Applicant admits as prior art (see paragraph 4) an electrolytic reduction cell for producing aluminum that includes at least one inert anode attached to a refractory support where the anodes and support are in contact with the molten salt bath. In addition, because of the random mixing of the fibers with the matrix material, one of ordinary skill in the art would have expected there to be cross over points as claimed, because at least some of the fibers would end up touching each other in the final support. Though "Permatech Beta 2HPSL (With Stainless Steel Fibers)" is silent as to the number of fibers protruding from the surface of the support, it was known that HF could corrode the stainless steel (see Dean, Jr at col. 1, lines 22-27). Therefore, it would have been obvious to have reduced the number of fibers protruding from the surface of the support to a low value, such as less than 20 per cm^2, in order to reduce the amount of corrosion of the fibers, thereby preventing failure of the composite. The fibers have the effect of improving thermal shock resistance. One of ordinary skill in the art would have expected the fibers to also reduce crack propagation caused by thermal shock.

Regarding claim 23, Applicant admits as prior art (see paragraph 4) an electrolytic process involving attaching at least one inert anode to a refractory support

where the anodes and support contact a molten salt bath and where corrosive gases contact the inert anode and the support at (see paragraph 2) temperatures up to 1000°C (i.e.-subjected to thermal shock). Though there is no explicit disclosure of metal being deposited from the molten salt bath, it is implicitly disclosed that aluminum is deposited in the process. Though "Permatech Beta 2HPSL (With Stainless Steel Fibers)" is silent as to the number of fibers protruding from the surface of the support, it was known that HF could corrode the stainless steel (see Dean, Jr at col. 1, lines 22-27). Therefore, it would have been obvious to have reduced the number of fibers protruding from the surface of the support to a low value, such as less than 20 per cm^2, in order to reduce the amount of corrosion of the fibers, thereby preventing failure of the composite.

Regarding claims 2, 8 and 18, the Beta 2HPSL refractory contains about 65.8% alumina.

Regarding claims 3, 9 and 19, the reinforced Beta 2HPSL used stainless steel fibers.

Regarding claims 5, 11 and 21, the metal fibers of "Refractories" have (see figure 4) a "concave cross-section". Because of the random mixing of the fibers with the matrix material, one of ordinary skill in the art would have expected there to be cross over points as claimed, because at least some of the fibers would end up touching each other in the final support. "Refractories" teaches that when stainless steel fibers (see figure 2 and 2nd paragraph on page 4) are added at 2-6 wt%, the thermal shock resistance of the refractory is improved. Therefore, it would have been obvious to one

of ordinary skill in the art to have added 2-6 wt% metal fibers for the purpose of improving the thermal shock resistance. Though "Permatech Beta 2HPSL (With Stainless Steel Fibers)" is silent as to the number of fibers protruding from the surface of the support, it was known that HF could corrode the stainless steel (see Dean, Jr at col. 1, lines 22-27). Therefore, it would have been obvious to have reduced the number of fibers protruding from the surface of the support to a low value, such as less than 10 per cm^2, in order to reduce the amount of corrosion of the fibers, thereby preventing failure of the composite.

Regarding claims 6, 12 and 22, Applicant admits as prior art (see paragraphs 2, 7 and 8) that the electrolyte is cryolite and the operating temperature is about 850-1000°C. The aluminum electrolysis apparatus inherently produces HF and O_2 gas (for support see Li at col. 5, lines 19-25).

Regarding claim 13, "Refractories" teaches adding the fibers (see figure 2) at 2-6 wt%. Beta 2HPSL contains (see Chemical Analysis) 5.1 wt% "Others" (i.e.-filler) and has a maximum use temperature of 1427°C.

Regarding claim 14, the metal fibers of "Refractories" have (see figure 4) a "concave cross-section" and teaches using them (see figure 2) at 2-6 wt%. Beta 2HPSL is 87-89% dense (11-13% porosity).

Regarding claim 15, as can be seen in figure 3 of "Refractories", the fibers have a length to thickness ratio in the range of 100:1 to 50:1.

4. Claims 4, 10, 16 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admission of prior art in view of "Permatech Beta 2HPSL

(With Stainless Steel Fibers)" and "Refractories" as applied to claims 1-3, 5-9, 11-15, 17-19 and 21-23 above, and further in view of Cheyrezy et al (US 6,478,867).

The teachings of Applicant's admission of prior art in view of "Permatech Beta 2HPSL (With Stainless Steel Fibers)" and "Refractories" are described above in paragraph no. 6.

Applicant's admission of prior art in view of "Permatech Beta 2HPSL (With Stainless Steel Fibers)" and "Refractories" do not teach adding a coating to the metal fibers containing an oxide of phosphorous.

Cheyrezy et al teach (see figure 9 and col. 5, line 57-col. 6, line 42) that stainless steel fibers dispersed in a ceramic matrix had been coated with a phophate (phosphorous oxide) coating in order to increase the fiber/matrix bonding.

Therefore, it would have been obvious to one of ordinary skill in the art to have coated the fibers of "Refractories" with a phosphate coating as taught by Cheyrezy et al because the phosphate coating improved the bonding between the fibers and the ceramic matrix.

Regarding claim 16, while Cheyrezy et al are silent about the thickness of the phosphate coating, it would have been within the expected skill of a routineer in the art to have optimized the coating thickness in order to maximize the increased bonding effect.

Response to Arguments

5. Applicant's arguments filed 15 October 2003 have been fully considered but they are not persuasive. Applicant argued that the combination of references does not teach

the claimed feature of limiting the number of fibers protruding from the outer surface of the support to less than 20 per cm^2, or 10 cm^2, as claimed.

In response to Applicant's argument, while the references (Applicant's admission, "Permatech Beta 2HPSL (With Stainless Steel Fibers)" and "Refractories") themselves are silent as to the number of fibers that protrude from the outer surface of the anode support, one of ordinary skill was aware of several facts, including (1)-from Dean, Jr. at col. 1, lines 22-27 - that stainless can be corroded by HF gas and (2)-from Bozer et al at col. 11, lines 27-32 - that in composites reinforced with fibers, any fibers protruding from the surface of the matrix could lead to corrosion. In view of these facts, one of ordinary skill in the art would have been motivated to reduce the number of fibers protruding from the surface of the anode support of Applicant's admission in view of "Permatech Beta 2HPSL (With Stainless Steel Fibers)" and "Refractories" because doing so would prevent corrosion of the stainless steel fibers, thereby avoiding any decrease in the properties added by the steel fibers.

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D Wilkins, III whose telephone number is 703-305-9927. The examiner can normally be reached on M-Th 10:00am-8:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V King can be reached on 703-308-1146. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Harry D Wilkins, III
Examiner
Art Unit 1742

hdw

ROY KING
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